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EXAMINER	
SAHA, BIJAY S	

ART UNIT	PAPER NUMBER
1793	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/577,323	KATAGIRI ET AL.	
	Examiner	Art Unit	
	BIJAY S. SAHA	1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 May 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *13-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *13-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

The amendment filed on 05/21/2009 under 37 CFR 1.312 has been entered.

Status of Application

The original **claims 1-12** have been cancelled. New claims **13-44** are pending and presented for the examination.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yoichi et al JP10088256 (hereinafter JP '256) in view of Shotaro et al JP2000128648 (hereinafter JP '648).

Regarding **claim 13**, JP '256 teaches a carbon nanotube composite material(Title), (a) comprising a process of kneading and dispersing a (i) metal powder (para 0013) and (ii) carbon nanotubes (example 1 para 0014, 0.5 to 5 μm in length considered long) in an amount of 5 to 30 volume % (claims 1 and 2).

JP '256 does not explicitly teach the process of sintering by discharge plasma.

JP '648 teaches (b) that sintering can be accomplished by high temperature which is produced by discharge plasma (Claims 1, 2, Table 1 and 2), allowing pulse current while pressing the knead-dispersed material between punches in a die (Fig 3, part # 1-4). The discharge plasma is utilized to produce high temperature that causes sintering.

At the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP ‘256 teaching) utilizing process of sintering by discharge plasma (JP ‘648 teaching). The suggestion or motivation for doing so would have been to make a homogeneous compact body that has low defects. A green body is sintered by the application of a suitable high temperature which is the fundamental requirement of sintering. A suitable high temperature can be produced either by conventional process where a green body is placed in a furnace; or alternatively, high temperature is produced by discharge plasma. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP ‘648, para 0099).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jung et al (App Surf Sc, 193, 2002, 129-137) (hereinafter Jung) in view of JP ‘648 and JP ‘256.

Regarding **claim 14**, Jung teaches that the electrical properties of carbon nanotubes (Figures 8, 9 and 10) by plasma discharge. Examiner considers the heat treatment of carbon nano tubes is caused due to the electrical plasma power since materials including the conductive materials respond to the plasma and generate heat.

Jung does not teach the following:

(1) the application of discharge plasma to the carbon nanotube prior to sintering or sintering with the mixture of the metal powder and carbon nanotubes.

(2) plasma sintering of the mixture of the metal powder and the carbon nanotubes.

JP '648 teaches application of discharge plasma in a clamped configuration (pressure 400kgf/cm2 para 0075 being applied between the punches in a die as shown in Fig 2), allowing pulse current while pressing the knead-dispersed material between punches in a die (Fig 3, part # 1-4).

JP '256 teaches a carbon nanotube composite material(Title), comprising a process of kneading and dispersing a (i) metal powder (para 0013) and (ii) carbon nanotubes (example 1 para 0014, 0.5 to 5 μm in length considered long) in an amount of 5 to 30 volume % (claims 1 and 2).

With respect to (1), at the time of invention it would have been obvious to a person of ordinary skill to expose the carbon nanotube (Jung teaching) and treating the carbon nanotubes by plasma (Jung teaching) while the plasma tube are clamped under pressure (JP '648). The suggestion or motivation for doing this preliminary treatment is to alter the surface electrical properties of carbon nanotubes so that end composite material containing the carbon nanotubes have a range of electrical

properties. Since carbon nanotubes are part of the composite material, the properties of the carbon nanotubes determine the properties of the composite material as well.

With respect to (2), the suggestion or motivation for doing so would have been to make a homogeneous compact body that has low defects. A green body is sintered by the application of suitable high temperature which is the fundamental requirement of sintering. A suitable high temperature can be produced either by conventional process where a green body is placed in a furnace; or alternatively, high temperature is produced by discharge plasma. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP '648, para 0099).

Combining (1) and (2), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) utilizing process of sintering by discharge plasma (JP '648 teaching) by treating the carbon nanotube by plasma discharge (Jung teaching). Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP '648, para 0099) with a range of electrical properties.

Claims 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '256 in view of JP '648 and Reddy et al (Jour Mat Sc, 37, 2002 pages 929-934) (hereafter Reddy).

Regarding **claim 15**, teachings of JP '256 in view of JP '648 have been delineated above in the 103 rejection of claim 13.

JP '256 does not explicitly teach the following:

(1) the wet dispersing of the mixture using a dispersing agent,

(2) plasma sintering of the mixture of the metal powder and the carbon nanotubes.

Teachings of JP '648 have been delineated above in the claim 13 rejection.

Reddy teaches a method of nano powder wet-dispersing using a dispersing agent (Table II page 930).

With respect to (1), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) by dispersing the solids in a wet stage using a surfactant (Reddy teaching). The suggestion or motivation for doing so would have been to make a homogeneous liquid dispersion that would make a homogeneous green body which would lead to compact body that has low defects. A combination of surfactant and wet medium allows enhanced mobility of nanosize particles. Enhanced mobility produces homogeneous distribution of chemical species that produces a uniform green body.

With respect to (2), the suggestion or motivation for doing so would have been to make a homogeneous compact body that has low sintering defects. A green body is sintered by the application of suitable high temperature, which is the fundamental

requirement of sintering. A suitable high temperature can be produced either by conventional process where a green body is placed in a furnace. Alternatively, high temperature is produced by discharge plasma. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP ‘648, para 0099).

Combining (1) and (2), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP ‘256 teaching) utilizing process of sintering by discharge plasma (JP ‘648 teaching) by dispersing the solids in a wet stage using a surfactant (Reddy teaching). The suggestion or motivation for doing so would have been to make a homogeneous liquid dispersion with surfactant that would lead to a homogeneous green body which would lead to compact body that has low defects. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP ‘648, para 0099).

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP ‘256 in view of JP ‘648, Jung and Reddy.

Regarding **claim 16**, teachings of JP ‘256 in view of JP ‘648 have been delineated above in the 103 rejection of claim 13.

JP '256 does not explicitly teach the following:

(1) the application of discharge plasma to the carbon nanotube prior to sintering with the mixture of the metal powder and carbon nanotubes,

(2) the wet dispersing of the mixture using a dispersing agent,

(3) plasma sintering of the mixture of the metal powder and the carbon nanotubes.

Teachings of JP '648 have been delineated above in claim 13 rejection. Further, JP '648 teaches application of discharge plasma in a clamped configuration (pressure 400kgf/cm2 para 0075 being applied between the punches in a die as shown in Fig 2), allowing pulse current while pressing the knead-dispersed material between punches in a die (Fig 3, part # 1-4).

Teaching of Jung has been delineated in the 103 rejection of claim 14 above.

Teaching of Reddy have been delineated in the 103 rejection of claim 15 above.

With respect to (1), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) and treating the carbon nanotubes by plasma (Jung teaching). The suggestion or motivation for doing this preliminary treatment is to alter the surface electrical properties of carbon nanotubes so that end composite material containing the carbon nanotubes have a range of electrical properties. Since carbon nanotubes are

part of the composite material, the properties of the carbon nanotubes determine the properties of the composite material as well.

With respect to (2), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) utilizing process of sintering by discharge plasma (JP '648 teaching) by dispersing the solids in a wet stage using a surfactant (Reddy teaching). The suggestion or motivation for doing so would have been to make a homogeneous liquid dispersion with surfactant that would lead to a homogeneous green body which would lead to compact body that has low defects. A combination of surfactant and wet medium allows enhanced mobility of nanosize particles. Enhanced mobility produces homogeneous distribution of chemical species that produces a uniform green body.

With respect to (3), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) utilizing process of sintering by discharge plasma (JP '648 teaching). The suggestion or motivation for doing so would have been to make a homogeneous compact body that has low defects. A green body is sintered by the application of suitable high temperature which is the fundamental requirement of sintering. A suitable high temperature can be produced either by conventional process where a green body is placed in a furnace, or alternatively, high temperature is produced by discharge

plasma. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP ‘648, para 0099).

Combining (1) and (2) and (3), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP ‘256 teaching) utilizing process of sintering by discharge plasma (JP ‘648 teaching) by dispersing the solids in a wet stage using a surfactant (Reddy teaching) and treating the carbon nanotube by plasma discharge (Jung teaching). The suggestion or motivation for doing so would have been to make a homogeneous liquid dispersion with surfactant that would lead to a homogeneous green body which would lead to compact body that has low defects. A combination of surfactant and wet medium allows enhanced mobility of nanosize particles while plasma treatment of carbon nanotube alters the surface electrical properties of carbon nanotubes so that end composite material containing the carbon nanotubes have a range of electrical properties. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP ‘648, para 0099).

Claims 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP ‘256 in view of JP ‘648.

Regarding **claim 17,** teachings of JP ‘256 have been delineated above in the 103 rejection of claim 13.

JP '256 does not explicitly teach the following:

(1) a process of treating the kneaded dispersed material with plasma discharge,

(2) plasma sintering of the mixture of the metal powder and the carbon nanotubes.

JP '648 teaches process of sintering by discharge plasma (Claims 1, 2). Further, JP '648 teaches application of discharge plasma in a clamped configuration (pressure 400kgf/cm2 para 0075 being applied between the punches in a die as shown in Fig 2), allowing pulse current while pressing the knead-dispersed material between punches in a die (Fig 3, part # 1-4).

With respect to (1), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) utilizing process of sintering by discharge plasma (JP '648 teaching). The suggestion or motivation for doing so would have been to make a homogeneous compact body that has low defects. A green body is sintered by the application of suitable high temperature which is the fundamental requirement of sintering. A suitable high temperature can be produced either by conventional process where a green body is placed in a furnace, or alternatively, high temperature is produced by discharge plasma. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP '648, para 0099).

With respect to (2), the process of sintering is caused by discharge plasma. Examiner interprets that the process of treating the knead-dispersed material by discharge plasma is equivalent to sintering the knead-dispersed material. Process of sintering the resultant dispersed material by discharge plasma is the extension sintering of the knead-dispersed material.

Combining (1) and (2), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP ‘256 teaching) utilizing process of sintering by discharge plasma (JP ‘648 teaching). The suggestion or motivation for doing so would have been to make a homogeneous compact product without a sintering defect (JP ‘648, para 0099).

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP ‘256 in view of JP ‘648 and Jung.

Regarding **claim 18,** teachings of JP ‘256 have been delineated above in the 103 rejection of claim 13.

JP ‘256 does not explicitly teach the following:

(1) the application of discharge plasma to the carbon nanotube prior to sintering with the mixture of the metal powder and carbon nanotubes,

(2) a process of treating the kneaded dispersed material with plasma discharge,

(3) plasma sintering of the mixture of the metal powder and the carbon nanotubes

Teachings of JP ‘648 have been delineated above in claim 13 rejection. Further, JP ‘648 teaches application of discharge plasma in a clamped configuration (pressure 400kgf/cm2 para 0075 being applied between the punches in a die as shown in Fig 2).

Jung teaches the alteration of electrical properties of carbon nanotubes (Figures 8, 9 and 10).

With respect (1), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP ‘256 teaching) and treating the carbon nanotubes by plasma (Jung teaching). The suggestion or motivation for doing this preliminary treatment is to alter the surface electrical properties of carbon nanotubes so that end composite material containing the carbon nanotubes have a range of electrical properties. Since carbon nanotubes are part of the composite material, the properties of the carbon nanotubes determine the properties of the composite material as well.

With respect (2), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP ‘256 teaching) utilizing process of sintering by discharge plasma (JP ‘648 teaching). The

suggestion or motivation for doing so would have been to make a homogeneous compact body that has low defects. A green body is sintered by the application of suitable high temperature which is the fundamental requirement of sintering. A suitable high temperature can be produced either by conventional process where a green body is placed in a furnace, or alternatively, high temperature is produced by discharge plasma. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP '648, para 0099).

With respect to (3), the process of sintering is caused by discharge plasma. Examiner interprets that the process of treating the knead-dispersed material by discharge plasma is equivalent to sintering the knead-dispersed material. Process of sintering the resultant dispersed material by discharge plasma is the extension sintering of the knead-dispersed material.

Combining (1), (2) and (3), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) utilizing process of sintering by discharge plasma (JP '648 teaching). The suggestion or motivation for doing so would have been to make a homogeneous compact body without a sintering defect and alter the surface electrical properties of carbon nanotubes so that end composite material containing the carbon nanotubes have a range of electrical properties.

Claims 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '256 in view of JP '648 and Reddy.

Regarding **claim 19**, teachings of JP '256 have been delineated above in the 103 rejection of claim 13.

JP '256 does not explicitly teach the following:

(1) the wet dispersing of the mixture using a dispersing agent,

(2) a process of treating the kneaded dispersed material with plasma discharge,

(3) plasma sintering of the mixture of the metal powder and the carbon nanotubes.

Teachings of JP '648 have been delineated above in claim 1 rejection. Further, JP '648 teaches application of discharge plasma in a clamped configuration (pressure 400kgf/cm2 para 0075 being applied between the punches in a die as shown in Fig 2), allowing pulse current while pressing the knead-dispersed material between punches in a die (Fig 3, part # 1-4).

Reddy teaches a method of nano powder wet-dispersing using a dispersing agent (Table II page 930).

With respect (1), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP ‘256 teaching) by dispersing the solids in a wet stage using a surfactant (Reddy teaching). The suggestion or motivation for doing so would have been to make a homogeneous liquid dispersion that would make a homogeneous green body which would lead to compact body that has low defects. A combination of surfactant and wet medium allows enhanced mobility of nanosize particles. Enhanced mobility produces homogeneous distribution of chemical species that produces uniform green body.

With respect to (2), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP ‘256 teaching) utilizing process of sintering by discharge plasma (JP ‘648 teaching). The suggestion or motivation for doing so would have been to make a homogeneous compact body that has low defects. A green body is sintered by the application of suitable high temperature which is the fundamental requirement of sintering. A suitable high temperature can be produced either by conventional process where a green body is placed in a furnace, or alternatively, high temperature is produced by discharge plasma. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP ‘648, para 0099).

With respect (3), the process of sintering is caused by discharge plasma. Examiner interprets that the process of treating the knead-dispersed material by discharge plasma is equivalent to sintering the knead-dispersed material. Process of

sintering the resultant dispersed material by discharge plasma is the extension sintering of the knead-dispersed material.

Combining (1), (2) and (3), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) utilizing process of sintering by discharge plasma (JP '648 teaching) by dispersing the solids in a wet stage using a surfactant (Reddy teaching). The suggestion or motivation for doing so would have been to make a homogeneous liquid dispersion that would make a homogeneous green body which would lead to compact body that has low defects. A combination of surfactant and wet medium allows enhanced mobility of nanosize particles. Enhanced mobility produces homogeneous distribution of chemical species. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP '648, para 0099).

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP '256 in view of JP '648, Jung and Reddy.

Regarding **claim 20**, teachings of JP '256 have been delineated above in the 103 rejection of claim 13.

JP '256 does not explicitly teach the following:

(1) the application of discharge plasma to the carbon nanotube prior to sintering with the mixture of the metal powder and carbon nanotubes,

(2) the wet dispersing of the mixture using a dispersing agent,

(3) a process of treating the kneaded dispersed material with plasma discharge,

(4) plasma sintering of the mixture of the metal powder and the carbon nanotubes.

Teachings of JP '648 have been delineated above in claim 13 rejection. Further, JP '648 teaches application of discharge plasma in a clamped configuration (pressure 400kgf/cm2 para 0075 being applied between the punches in a die as shown in Fig 2), allowing pulse current while pressing the knead-dispersed material between punches in a die (Fig 3, part # 1-4).

Teaching of Jung has been delineated in the 103 rejection of claim 14 above.

Teaching of Reddy have been delineated in the 103 rejection of claim 15 above.

With respect to (1), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) and treating the carbon nanotubes by plasma (Jung teaching). The suggestion or motivation for doing this preliminary treatment is to alter the surface electrical properties of carbon nanotubes so that end composite material containing the

carbon nanotubes have a range of electrical properties. Since carbon nanotubes are part of the composite material, the properties of the carbon nanotubes determine the properties of the composite material as well.

With respect to (2), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) by dispersing the solids in a wet stage using a surfactant (Reddy teaching). The suggestion or motivation for doing so would have been to make a homogeneous liquid dispersion that would make a homogeneous green body which would lead to compact body that has low defects. A combination of surfactant and wet medium allows enhanced mobility of nanosize particles. Enhanced mobility produces homogeneous distribution of chemical species that produces uniform green body.

With respect to (3), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) utilizing process of sintering by discharge plasma (JP '648 teaching). The suggestion or motivation for doing so would have been to make a homogeneous compact body that has low defects. A green body is sintered by the application of suitable high temperature which is the fundamental requirement of sintering. A suitable high temperature can be produced either by conventional process where a green body is placed in a furnace, or alternatively, high temperature is produced by discharge

plasma. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP '648, para 0099).

With respect to (4), the process of sintering is caused by discharge plasma. Examiner interprets that the process of treating the knead-dispersed material by discharge plasma is equivalent to sintering the knead-dispersed material. Process of sintering the resultant dispersed material by discharge plasma is the extension sintering of the knead-dispersed material.

Combining (1), (2), (3) and (4), at the time of invention it would have been obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '256 teaching) utilizing process of sintering by discharge plasma (JP '648 teaching) by dispersing the solids in a wet stage using a surfactant (Reddy teaching) and treating the carbon nanotube by plasma discharge (Jung teaching). The suggestion or motivation for doing so would have been to make a homogeneous liquid dispersion with surfactant that would lead to a homogeneous green body which would lead to compact body that has low defects. A combination of surfactant and wet medium allows enhanced mobility of nanosize particles while plasma treatment of carbon nanotube alters the surface electrical properties of carbon nanotubes so that end composite material containing the carbon nanotubes have a range of electrical properties. Discharge plasma sintering of a green body produces homogeneous finished product without a sintering defect (JP '648, para 0099).

Claims 21-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over references as applied to claim numbers 13, 14, 15, 16, 17, 18, 19 and 20 for claim numbers 21, 22, 23, 24, 25, 26, 27 and 28, respectively, further in view of JP'648.

Regarding **claims 21-28**, JP '648 teaches the particle size of granular material in the range of 0.1 micrometer to 200 micrometer (claim 12). Examiner considers that, since the granular material includes metal particles and the ceramic particles, the size of the metal and ceramic particles is expected to be less than 200 μm. Examiner further considers:" In MPEP 2144.05 [R-5] Obviousness of Ranges, "In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists".

Claims 29-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over reference as applied to claim numbers 13, 14, 15, 16, 17, 18, 19 and 20 for claim numbers 21, 22, 23, 24, 25, 26, 27 and 28, respectively, further in view of JP'648.

Regarding **claims 29-44**, JP '648 teaches application of alumina (para 0073) and aluminum, copper and stainless steel (pare 0025).

Summary

The claims 13-44 are rejected.

Response to Arguments

Applicant's arguments filed on 05/21/2009 under 37 CFR 1.312 have been fully considered but they are not persuasive.

Claim Rejections - 35 USC § 112 have been withdrawn.

Applicants argue about knead-dispersed material, long chain carbon nao tubes, die with a pressure of 10 MPa and treatment by discharge plasma and associated sintering.

JP '256 clearly teaches a dispersion between the carbon nanotubes and metal with ceramic composite material(Title). Carbon nano tubes are dispersed in a composite body that contains carbon nano tubes, metal powder and the ceramic material. The carbon nano tubes, per the teaching of JP'256 are up to 5 μm in length are considered long since the diameter of nanotubes is of the order of nanometers.

JP '648 teaches that sintering where the material to be sintered is place between the die under a pressure of 400kgf/cm2. The plasma, as taught by JP '648, generates the temperature that causes the sintering. As taught by JP '648, sintering by plasma is more efficient compared to the conventional thermal sintering where the temperature is produced by placing the composite powder in a furnace. The discharge plasma is

utilized to produce high temperature that causes sintering. Temperature produced by the discharge plasma with the help of pressure applied between the die makes the sintering more efficient compared to a composite powder without any pressure placed in a furnace without the presence of plasma. Further as JP ‘648 teaches, application of pressure and discharge plasma are two independent processes. Plasma would react with the dispersants in the die; application of pressure in the die makes the sintering more effective.

By a combination of JP ‘256 and JP ‘648 a person of ordinary skill would be motivated to sinter a composite material more efficiently since plasma sintering is virtually defect free compared to conventional thermal sintering.

Wet techniques, as taught by Reddy, make the dispersion more homogeneous compared to a dry dispersion. In a liquid, the solid dispersants such as carbon nano tube, ceramic material such as alumina and metal particles move around to reduce any concentration gradient of a particular solid; hence, make the composition uniform.

By a combination of JP ‘256 and Reddy, a person of ordinary skill would be motivated to produce a dispersion what is expected to be more uniform.

Jung teaches that carbon nano tubes are affected by the presence of plasma. Jung further teaches that surface electrical properties of nano tubes are influenced by

plasma when the carbon nano tubes are grown by a conventional CVD process in comparison to a CVD process in the presence of plasma. Plasma is maintained by pulse current.

JP ‘648 does not explicitly teach the inclusion of carbon nano tube in the die at a pressure of 400kgf/cm2 but teaches discharge plasma in the die containing a ceramic material for enhanced sintering.

By a combination of Jung and JP ‘648 a person of ordinary skill would be motivated to include the carbon nano tubes in the die containing the dispersants to make the process more versatile.

Finally, a combination of JP ‘256 (carbon nano tube, metal and ceramic powder dispersion), Jung (carbon nano tube electrical response to the applied plasma), JP ‘648 (plasma discharge sintering) and Reddy (wet dispersion), a person of ordinary skill would be motivated to make a carbon nano tube containing composite material a versatile efficient process that would be virtually defect free compared to conventional thermal sintering.

Examiner has provided a signed copy of the IDS with this Office Action.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BIJAY S. SAHA whose telephone number is (571) 270-5781. The examiner can normally be reached on Monday- Friday 8:00 a.m. EST - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis Mayes can be reached on (571) 272 1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BIJAY S SAHA/
Examiner, Art Unit 1793

BSS

July 16, 2009

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1793